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Check List
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Lists of Species

The Herbaceous Lacustrine Macrophytes of Indiana, United States of America

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Abstract: We provide the first checklist of the obligate aquatic macrophytes of Indiana, including the geographical distribution and frequency of occurrence of each taxon. The checklist is composed of 216 taxa distributed among 85 genera within 43 families. Families exhibiting the greatest richness of taxa are the Potamogetonaceae and Cyperaceae. Approximately 50 % of these taxa are widespread, whereas only 3.7 % are restricted to either the northern or southern regions of the state. An identification code is provided for each taxon and coefficients of conservatism (C values) are given for 189 native taxa, including 18 species of characean algae. C values assigned to native taxa range from 0-10, with a median value of 6. The C values of aquatic macrophytes presented here bear greater similarity to those proposed by Rothrock (2004) for the State of Indiana than to those established by Swink and Wilhelm (1994) for the Chicago region.

Introduction

Despite having a diversity of lakes and a long history of botanical studies, Indiana lacks a synoptic account of its aquatic macrophytes. Classic comprehensive floras of Indiana that have included aquatic macrophytes are the seminal works of Coulter (1900) and Deam (1940), the checklist of Crovello *et al.* (1983), and Yatskievych's (2000) Indiana wildflower field guide. Although these publications provide a wealth of information, all but the latter are now well out-of-date and do not reflect our current knowledge of Indiana's lacustrine flora. Much of the distributional and ecological information on the aquatic macrophytes of Indiana must be gleaned from a variety of regional floras or technical reports associated with the Lake and River Enhancement Program (LARE) of the Indiana Department of Natural Resources (IDNR). Unfortunately, the accuracy of some records included in the latter reports are difficult to confirm because identification is often based on vegetative material and voucher specimens are typically not prepared and deposited in an officially recognized herbarium.

Over the course of a decade, we have conducted floristic surveys and assessments of over 150 lacustrine and palustrine habitats across the state of Indiana in an attempt to gain a better understanding of the ecology, distribution, and abundance of its aquatic macrophytes. These surveys and assessments have resulted in the discovery of species new to the state (Scribailo and Alix 2002a; 2006; Alix and Scribailo 2006a) and new records of state-listed species (Alix and Scribailo 2001; Scribailo and Alix 2002b), which in turn has led to the reassignment of state ranks for a number of taxa. Several new hybrid pondweeds, such as *Potamogeton × undulatus* Wolfg. in Schult. and Schult. f., 1827 (Alix and Scribailo 2006a), *P. × rectifolius* A. Benn., 1902 and *P. × spathuliformis* (J. W. Robbins) Morong, 1893 have also been identified from these surveys. During this time, we have hosted short courses and workshops on the identification of aquatic plants and provided ecological information and taxonomic assistance on aquatic plants to environmental consultants as well as a variety of federal, state, and local agencies. In some cases, these cooperative efforts have resulted in the discovery of exotic species new to Indiana, such as *Egeria densa* Planch., 1849, *Hydrilla verticillata* (L. f.) Royle, 1839 (Keller 2007; Alix *et al.* 2009), and *Myriophyllum aquaticum* (Vell.) Verdc., 1973 (Alix *et al.* unpubl. data). Our overall experiences, coupled with inquiries and feedback we have received, indicate that the absence of a checklist of the lacustrine macrophytes of Indiana is an impediment to efforts to accurately document and monitor the species richness of Indiana lakes. Therefore, the primary objective of the paper is to provide an up-to-date checklist of the non-woody aquatic macrophytes of Indiana's natural lakes and impoundments and to present information on the distribution, frequency of occurrence, and where applicable, the conservation status of each taxon. A second objective of this paper is to assign coefficients of conservatism (*C* values) to native taxa included in the checklist. The assignment of *C* values serves as the foundation of the Floristic Quality Assessment (FQA) methodology developed by Swink and Wilhelm (1994) for the Chicago region, which includes seven counties in northwest Indiana. This methodology, or modifications thereof (see Alix and Scribailo 2006b), provides a rapid assessment tool useful in the evaluation of lake quality (for a comprehensive explanation of FQA, see Swink and Wilhelm 1994). The IDNR's LARE program currently funds a variety of lake projects most of which require aquatic macrophyte surveys as an initial step in lake assessment. Although FQA is not typically utilized in the analyses of these macrophyte surveys, *C* values provided in the current checklist should help facilitate this process. The inclusion of these proposed *C* values was also thought to be of importance because of our observation that many of the *C* values assigned by Swink and Wilhelm (1994) to aquatic macrophytes did not seem to represent an appropriate level of conservatism for these taxa when

used in the assessment of Indiana lakes. While studies contributing to the development of the current checklist were in progress, Rothrock (2004) published *C* values for the vascular flora of Indiana, and Rothrock and Homoya (2005) compared the Indiana values with those established by Swink and Wilhelm (1994). Because one of our goals in presenting the current checklist is to provide *C* values that most accurately reflect the fidelity of taxa relative to lake quality, a third objective of this paper is to assess the similarity between our *C* values and those of Swink and Wilhelm (1994) and Rothrock (2004), and to explain some possible reasons for the observed similarities and differences in the values.

Materials and Methods

Checklist

The primary emphasis has been placed on the inclusion of submerged, free-floating, and floating-leaved aquatic macrophytes associated with littoral zone habitats of Indiana lakes. Many obligate aquatic grasses and sedges, though typically found in wetlands, have been excluded since they are rare inhabitants in the littoral zones of Indiana lakes. All woody aquatic plant taxa have been omitted from the checklist since they are not typically included in aquatic macrophyte surveys designed to evaluate lake quality in Indiana. This checklist represents a compilation and synthesis of historical and current information on aquatic macrophytes obtained from in- and out-of-state sources, such as primary and secondary literature and herbarium records, as well as floristic surveys conducted by the authors over a span of 10 years. The framework of the vascular plant portion of the checklist is based on the classic works of Coulter (1900) and Deam (1940), and other relevant publications and databases, such as Crovello *et al.* (1983), Swink and Wilhelm (1994), Yatskievych (2000), and Rothrock (2004). The charophyte section of the checklist is based on Daily's (1945; 1953) studies on the Characeae of Indiana. Characean algae are rarely included in the assessment of floristic quality because they typically are not collected or identified to species and have not been previously assigned *C* values (Alix and Scribailo 1998; 2006b). Since the ecological attributes of characean algae greatly contribute to the ecosystem quality and stability of lakes and ponds (see Hutchinson 1975; Jeppesen *et al.* 1998; Van den Berg *et al.* 1998; Coops 2002) and members of this group of macrophytes are a major component of the flora of Indiana lakes in both abundance and diversity, we have included *C* values for the Indiana members of this group. Information from the aforementioned sources has been supplemented with data obtained from voucher specimens curated at the Kriebel Herbarium of Purdue University (PUL), Indiana University (IND), Field Museum of Natural History (F), University of Notre Dame, South Bend (NDG), Herbarium of the University of Illinois, Urbana (ILL), and the Herbarium of the Chicago Academy of Sciences (CACS).

Current information on the state-wide distribution and frequency of occurrence of many of the taxa listed herein is derived from floristic surveys of 92 natural and man-made lakes carried out from 1993 through 2007 across 21 counties and five ecoregions of Indiana (Table 1, Figure 1). Sampling intensity was greater in the Central Corn Belt Plains and the Southern Michigan-Northern Indiana Drift Plains (Figure 1) since these ecoregions contain a majority of Indiana's natural lakes and have a greater diversity of aquatic macrophytes. These surveys utilized both in-boat (i.e. visual inspections and rake-assisted collections) and in-water sampling techniques, such as snorkeling and SCUBA.

Systematics

Taxonomy and nomenclature of vascular aquatic macrophytes follow familial treatments of the Flora of North America Editorial Committee (1994; 1997; 2000; 2002a; b; 2003; 2005; 2006; 2007) with the following exceptions: Apiaceae, Brassicaceae, Lythraceae, Menyanthaceae, Onagraceae, Primulaceae, and Scrophulariaceae (Gleason and Cronquist 1991), Haloragaceae (Aiken 1981), Lentibulariaceae (Taylor 1989), and Plantaginaceae (The Angiosperm Phylogeny Group 2003). Taxonomic treatment of the Characeae follows Daily (1953) with nomenclatural revisions where necessary (see Wood 1965), and that of the Ricciaceae follows Mayfield *et al.* (1983). Infrageneric designations within *Nuphar* (Nymphaeaceae) follow the recent monograph by Padgett (2007). Surnames of nomenclatural authorities have been abbreviated following the rules recommended by Brummitt and Powell (1992) and are from the International Plant Names Database (2004). The terms 'taxon' and 'taxa' are commonly used throughout the text in reference to specific or infraspecific taxonomic ranks.

Taxon identification codes

Taxon identification codes (TICs) were created to formally standardize truncations of scientific names of aquatic plant taxa included in the checklist (Table 2). These codes can be used for database entry, the customization of data dictionaries used with global positioning systems (GPS), and shorthand field data entry forms. Indiana TICs have been derived from methods similar to those outlined in Taft *et al.* (1997). Each TIC for a given taxon consists of the first three letters of the genus followed by the first three letters of the specific epithet (e.g. *Potamogeton epihydrus* Raf., 1811 = POTEPI). The TIC of a taxon classified at the subspecific or varietal taxonomic rank is made up of the first three letters of the genus, followed by the first two letters of the specific epithet, and ends with the first letter of the infraspecific name (e.g. *Potamogeton pusillus* L., 1753 subsp. *pusillus* = POTPUP and *P. pusillus* subsp. *tenuissimus tenuissimus* (Mert. and Koch) R. R. Haynes and Hellq., 1996 = POTPUT). To avoid intergeneric code duplication, the third letter in the respective TICs is replaced with the first letter that is different in the spellings of the genera. For example, this type of code duplication would occur between the genera *Wolffia* and *Wolffiella*; however, the former genus is represented as WOA and the latter as WOE. Similarly, infrageneric code duplication is avoided by replacing the sixth letter in the respective TICs with the first letter that is different in the spellings of the specific epithets. As an example, infrageneric code duplication would occur with *Lemna minor* L., 1753 and *Lemna minuta* Kunth. in Humb. *et al.*, 1816 (i.e. both TICs would result in LEMMIN); however, by substituting the sixth letter (N) in each of the codes with the first different letter within

their specific epithets results in LEMMIO and LEMMIU, respectively.

Assignment of C values

In regions and states, where the FQA methodology of Swink and Wilhelm (1994) has been adopted or further developed as an assessment tool, the assignment of *C* values often represents a cooperative effort among professional botanists. Typically, a committee or panel is formed, whose members are familiar with the ecological attributes of taxa within their local flora. Level of invasiveness, sensitivity to disturbance, patterns of occurrence independent of rarity, and fidelity to pre-settlement conditions are some of the key attributes upon which professional botanists base their judgments and assignments of *C* values (see Swink and Wilhelm 1979; 1994; Taft *et al.* 1997; Nichols 1999; Rothrock 2004). In this study, each author independently assigned *C* values (AMI *C* values) to all native taxa included in the checklist (Table 2) based on the following parameters: *C* values of 0 or 1 are assigned to widespread and common taxa believed to or have been shown to have broad ecological tolerances, often occurring in the most degraded lake habitats and having no apparent fidelity to high quality lake areas, though they frequently may occur in the latter; *C* values of 2 or 3 are assigned to taxa, which are believed to or have been shown to have little fidelity to high quality lake areas and often occurring in a wide variety of lake habitats; *C* values from 4 to 6 are assigned to taxa, which are believed to or have been shown to have moderate fidelity to high quality lake areas and often capable of withstanding moderate levels of disturbance; *C* values of 7 or 8 are assigned to taxa, which are believed to or have been shown to have fidelity to high quality natural areas and are often capable of withstanding minor levels of disturbance; *C* values of 9 or 10 are assigned to taxa, which are believed to or have been shown to have high fidelity to high quality lake areas and are often intolerant of disturbance and typically restricted to high quality lake habitats.

The above approach resulted in two lists of preliminary *C* values that were exchanged between each author for review and assessment, which resulted in disagreement on only 10 % of the AMI *C* values of the taxa included in the checklist. When the difference between two preliminary *C* values for a given taxon was greater than 1, that taxon was assigned the average of the two values. This method is similar to that outlined in Swink and Wilhelm (1994). When the difference between the *C* values was 1, the more conservative (i.e. higher) value was assigned to that taxon. The AMI *C* values were finalized and are provided in Table 2.

Analyses of C values

Two datasets were created for separate, but identical analyses: 1) a set of *C* values of taxa common between those given in Table 2 and those from Rothrock (2004), referred to herein as SI *C* values; 2) a set of *C* values of taxa common between those given in Table 2 and those from Swink and Wilhelm (1994), referred to herein as CR *C* values. Taxa absent from one source, but present in another (e.g. AMI *C* values of charophytes) were excluded from these datasets and subsequent analyses. Cumulative frequency distributions of common sets of *C* values (i.e. AMI vs. SI and AMI vs. CR) and plots of the divergence of AMI *C* values from SI and CR *C* values were constructed. The cumulative frequency distributions of common sets of *C* values were compared by Kolmogorov-Smirnov two-sample tests using SYSTAT® version 9.1. Differences between frequency distributions were further analyzed using Mann-Whitney *U* tests utilizing normal approximation and a constant (Zar 1974). Nonparametric two-sample tests were conducted since these data do not meet the assumptions of normality required for the application of analogous parametric statistical tests. *P* values less than 0.05 are considered significant.

Table 1. Summary of Indiana lakes and reservoirs surveyed between 1993 and 2007, including county, survey year (in parentheses), and level III ecoregion (Omernik and Gallant 1988). Abbreviations: CCBP = Central Corn Belt Plains; ECBP = Eastern Corn Belt Plains; IP = Interior Plateau; IRVH = Interior River Valley and Hills; SMNIDP = Southern Michigan-Northern Indiana Drift Plains.

County	Lake	Ecoregion
Bartholomew	Crystal (2001); Long (2001); Wood (2001)	ECBP
Daviess	Dogwood (2001), Long (2001)	IRVH
Fulton	Bruce (1998); Manitou (2006); Nyona (2006); South Mud (2006)	ECBP
Greene	Kickapoo (2001); Lenape (2001)	IRVH
Kosciusko	Kaiser (2001); Shock (2004)	SMNIDP
LaGrange	Appleman (2004); Atwood (2006); Dallas (2006); Fish (1999); Little Beaver (2000); Little Turkey (2000); Messick (2006); Oliver (1999); Sylvan (2001)	SMNIDP
Lake	Red Wing (1998); Wolf (2000); Etta (2000); Grand Boulevard (2000)	CCBP
LaPorte	Clear-LP (1998); Clear-RP (2000); Crane (1998); Fish (1999); Fishtrap (1998); Hog (1998); Horseshoe (1998); Hudson (1998); Lily (1998); Lower (2006); Mill Creek Pond (2002); Pine (2000); Pottawattamie (2003); Red Mill Pond (2004); Round (1998); Saugany (1998); Silver (2000); Stone (1998); Walton (1998);	SMNIDP
Marshall	Lake of the Woods (1998)	SMNIDP
	Maxinkuckee (1998)	ECBP
Monroe	Griffy (2000); Lemon (2000)	IP
Noble	Diamond (2004); Steinbarger (2000); Sylvan (2000); Upper Long (1993); Waldron (2000)	SMNIDP
Orange	Patoka (2001)	IP
Perry	Celina (2001); Indian (2001); Tipsaw (2001)	IP
Porter	Bulls eye (1999); Canada (1999); Carlson (1999); Deep (1999); Flint (1999); Long (1999); Long-IDNL (1999); Loomis (1999); Mink (1999); Moss (1999); Round (1999); Silver (2004); Silver Dollar (1999); Spectacle (1999); Wauhob (1999)	CCBP
	Clear (1999)	SMNIDP
St. Joseph	Pleasant (1999); Riddles (1999); Worster (2003)	CCBP
	Mud (1998); Chamberlain (1998)	SMNIDP
Starke	Bass (2007)	ECBP
Steuben	Little Grass (1999); Loon (1999); Marsh (1999); West Otter (2005)	SMNDP
Sullivan	Shakamak (2001); Turtle Creek Reservoir (2001)	IRVH
Warren	Kates Pond (1999)	CCBP
White	Shaffer (1999)	ECBP
Whitley	Blue (2004); Crooked (2000); Robinson (2004); Round (2000)	ECBP

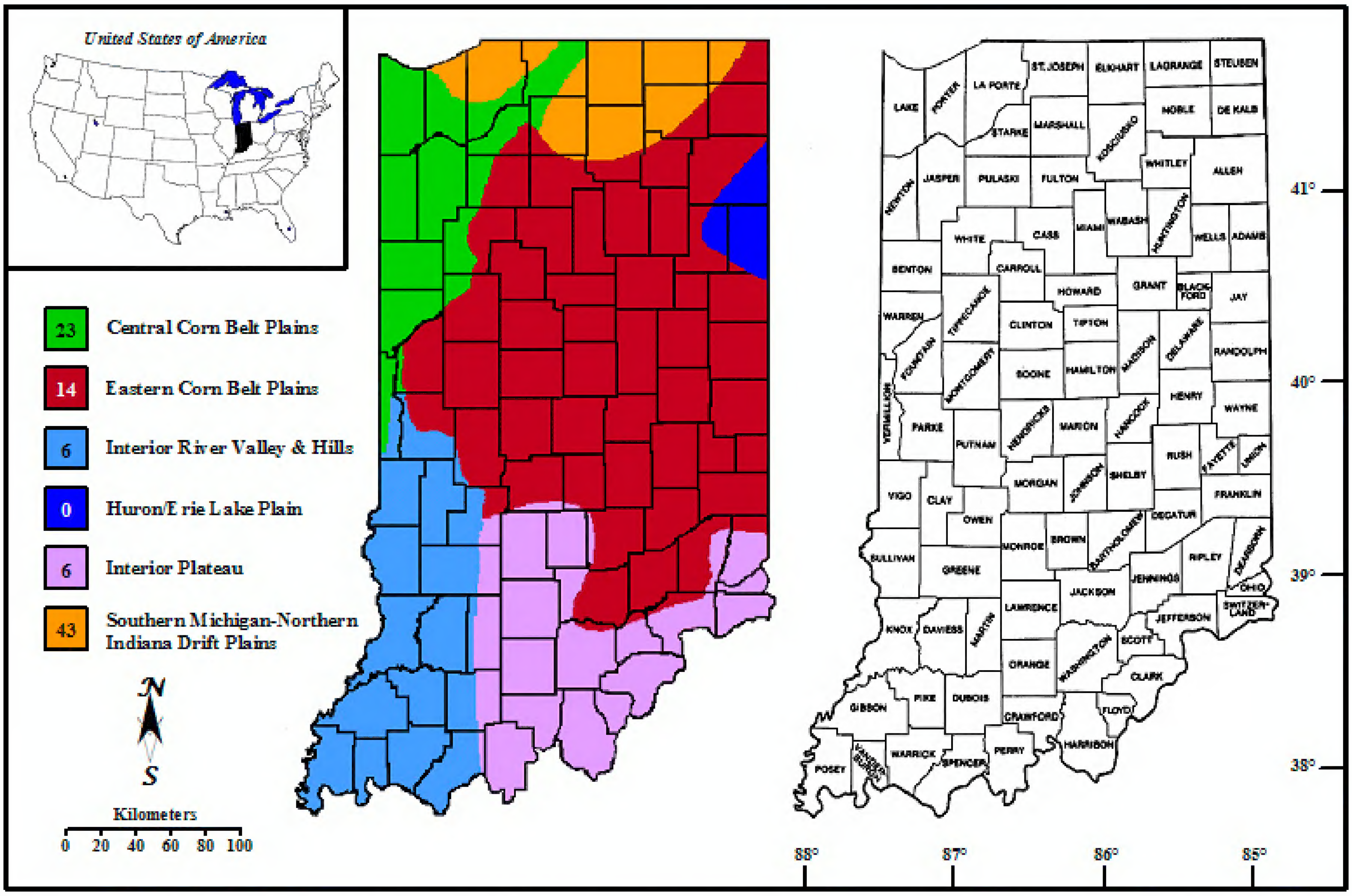

FIGURE 1. Maps of Indiana. Right, counties of Indiana. Left, level III ecoregions of Indiana (adapted from Omernik and Gallant 1988). Values in the legend boxes represent the total number of water bodies surveyed from a given ecoregion used in the assembly of the checklist and in the assignment of *C* values.

RESULTS AND DISCUSSION

Checklist

The checklist of aquatic macrophytes of Indiana contains 216 taxa, which includes 162 (75.0 %) native species, 12 (5.6 %) native subspecies, 15 (6.9 %) native varieties, 23 (10.6 %) non-native species, and four (1.9 %) hybrids (Table 2). These taxa represent 85 genera from 43 families. Families represented by five or more taxa include the Potamogetonaceae (25), Cyperaceae (21), Characeae (19), Lemnaceae (14), Alismataceae (13), Lentibulariaceae (10), Haloragaceae (8), Onagraceae (7), Hydrocharitaceae (6), Najadaceae (6), Poaceae (6), Polygonaceae (6), Juncaceae (5), Lythraceae (5), and Sparganiaceae (5). Families represented by only one taxon include the Acanthaceae, Azollaceae, Asteraceae, Butomaceae, Clusiaceae, Eriocaulaceae, Marsileaceae, Sauraceae, Thelypteridaceae, and Zannichelliaceae. Based on designations from the Indiana Department of Natural Resources (Indiana Natural Heritage Program 2007), 27 taxa are state-listed as endangered, whereas 15, nine, and three taxa are state-listed as threatened, rare, and extirpated, respectively (Figure 2A). Families with the greatest number of state-listed taxa are the Potamogetonaceae (11), Lentibulariaceae (8), Cyperaceae (5), and the Lemnaceae (4). Species designated as extirpated include *Echinodorus berteroi* (Spreng.) Fassett, 1955, *Hippuris vulgaris* L., 1753, and *Lemna perpusilla* Torr., 1843 (Table 2). Four species, *Utricularia intermedia* Hayne, 1800, *Najas marina* L., 1753, *Nelumbo lutea* Willd., 1799, *Menyanthes trifoliata* L., 1753, and one subspecies, *Potamogeton pusillus* subsp. *pusillus*, have a watch list designation (Table 2).

Based on the frequency of occurrence categories outlined in Table 2, 3 % of the listed taxa are considered abundant in Indiana, whereas 57 % are categorized as common and occasional and 40 % are considered to be rare (Figure 2B). The most abundant taxa are *Chara contraria* A. Braun ex Kütz., 1845, *C. globularis* Thuill., 1799, *Ceratophyllum demersum* L., 1753, *Nuphar advena* (Aiton) W. T. Aiton, 1811 subspecies *advena*, *Stuckenia pectinata* (L.) Börner, 1912, *Typha latifolia* L., 1753, and *T. angustifolia* L., 1753 (Table 2). Approximately 50 % of the listed taxa are widespread and found throughout the state, whereas 16.7 % and 7.9 % appear to be restricted to the northern and southern portions of the state, respectively (Table 2).

Assignment of C Values

One hundred and eighty-nine native aquatic macrophytes were assigned *C* values, which included 163 angiosperms from 36 families, 18 species of charophytes represented by three genera, two liverwort species, and six seedless vascular plants from four families (Table 2). *C* values ranged from 0 to 10, with a median *C* value of 6; only one taxon, *Phragmites australis* (Cav.) Trin. ex Steud., 1841 subsp. *americanus* Saltonst., P. M. Peterson, and Soreng, 2004, was assigned a *C* value of 0. Seventy percent

of taxa were assigned a *C* value from 5 to 10 (Figure 3A). The frequency distribution of *C* values is skewed to the left primarily due to a large number of taxa assigned *C* values of 10 (Figure 3A). Although no conscious emphasis was placed on assigning higher *C* values to state-listed taxa, 66 % of these taxa have a *C* value ranging from 8 to 10.

Analysis of C Values

Of the 189 taxa assigned AMI *C* values (Table 2), 164 taxa are in common with those of Rothrock (2004) and 142 taxa are in common with those of Swink and Wilhelm (1994). The frequency distributions of AMI and SI *C* values (Figure 3B) are not significantly different as indicated by the Kolmogorov-Smirnov two-sample test (D_{max} = 0.116; two-tailed P = 0.221). In contrast, the frequency distributions of AMI and CR *C* values (Figure 3C) are significantly different (D_{max} = 0.317; two-tailed P <0.0001). The frequency distribution of CR *C* values is clearly skewed further to the left than that of the AMI *C* values (Figure 3C), indicating that Swink and Wilhelm (1994) assigned much higher *C* values to a majority of the taxa listed in Table 2. In fact, only seven taxa out of the 142 in common between the AMI checklist and the Chicago region have been assigned a *C* value <4, whereas over 75 % of the remaining taxa have been assigned a *C* value ≥6 (Figure 3C).

A taxon by taxon analysis of the divergence of AMI *C* values from those of SI and CR indicates that 91 % and 36 % of the aquatic plant taxa listed in Table 2 have been assigned the same *C* values, respectively (Figure 4A). The overall mean divergences of AMI *C* values from those of SI and CR are 0.8 and 1.9, respectively. As a whole, AMI *C* values are approximately two *C* values lower than CR *C* values (Mann-Whitney, U = 9427; Z = 3.03; one-tailed P <0.001). Only 25 % of aquatic plant taxa diverged from SI *C* values by 2 or more integrals, whereas 57 % of taxa diverged by at least 2 integrals from CR *C* values (Figure 4B). The largest differences in AMI *C* values from SI *C* values are observed in taxa assigned a *C* value of 7 and 8 where the *C* values have a mean divergence of 1.3 and 1.4, respectively (Figure 4B). In contrast, the greatest mean divergence (3.4) of AMI *C* values from CR *C* values is observed in taxa assigned a *C* value of 3 (Figure 4B).

Although it is not the purpose of this paper to explain all of the observed differences in *C* values between common taxa within the AMI, SI, and CR datasets, a representative example can provide some insight as to why some of these disparities may exist. The family Potamogetonaceae contains the largest number of state-listed and total taxa included in the checklist. Of the 21 pondweed taxa in common between our checklist and Rothrock (2004), nine taxa have *C* values two or more integrals lower than the latter author's values, whereas six have an identical value of 10 and only two are higher. Similarly, of the 19 pondweed taxa in common between our checklist and Swink and Wilhelm (1994), 12 taxa have *C* values two or more integrals lower than the latter author's values. Five have an identical value of 10 and none are higher. The greater number of *C* values of 10 assigned by both Rothrock (2004) and Swink and Wilhelm (1994) to pondweeds indicate that they consider a number of taxa to be of higher fidelity to habitats similar to those of presettlement conditions than we suggest. These differences are likely attributable to at least two factors. First, collections of aquatic macrophytes are both historically and currently rare in Indiana, leading to the impression of an apparent rarity and narrow fidelity of some taxa, such as pondweeds. This impression has contributed to the assignment of inflated *C* values for these taxa and others. Second, a shortage of adequate habitat data on the aquatic macrophytes of Indiana has led to a reliance on information of this type from adjacent states where these taxa do not necessarily exhibit similar presettlement affinities. Observations from our extensive aquatic plant surveys of lakes have indicated that many taxa, pondweeds in particular, are more common and distributed over lakes of a wider range of water quality and disturbance than is suggested by the higher *C* values assigned by Rothrock (2004) and Swink and Wilhelm (1994). It is also important to note that the general tendency for CR *C* values to be significantly higher than those of both the SI and AMI *C* values may be a reflection of the fact that a greater proportion of taxa will appear to have higher fidelity when the region for which FQA is developed is geographically smaller.

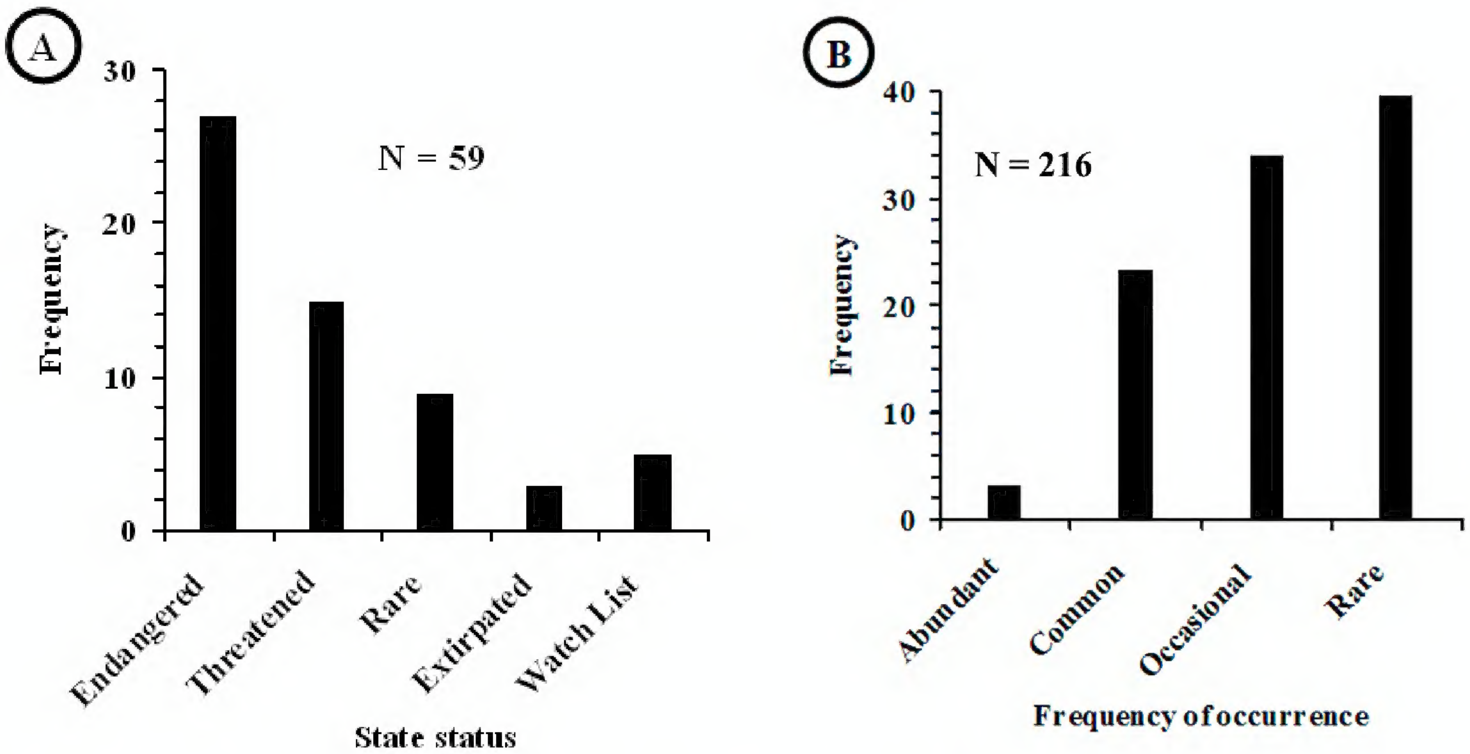

FIGURE 2. Frequency distributions of aquatic plants of Indiana: A) grouped by state status; B) grouped by frequency of occurrence. Frequency represents the number of taxa within the same group. N = total number of taxa within all groups.

The results of this study underscore the importance of further ecological studies of the aquatic macrophytes of Indiana. These studies, particularly if they were coupled with the collection of habitat data, would provide additional information on the nature of habitat fidelity for some taxa and contribute to the refinement of their *C* values, thus improving the effectiveness of FQA (Swink and Wilhelm 1994) for the evaluation of lake quality. The presentation of this checklist will hopefully provide a tool useful in the facilitation of further floristic studies on Indiana lakes.

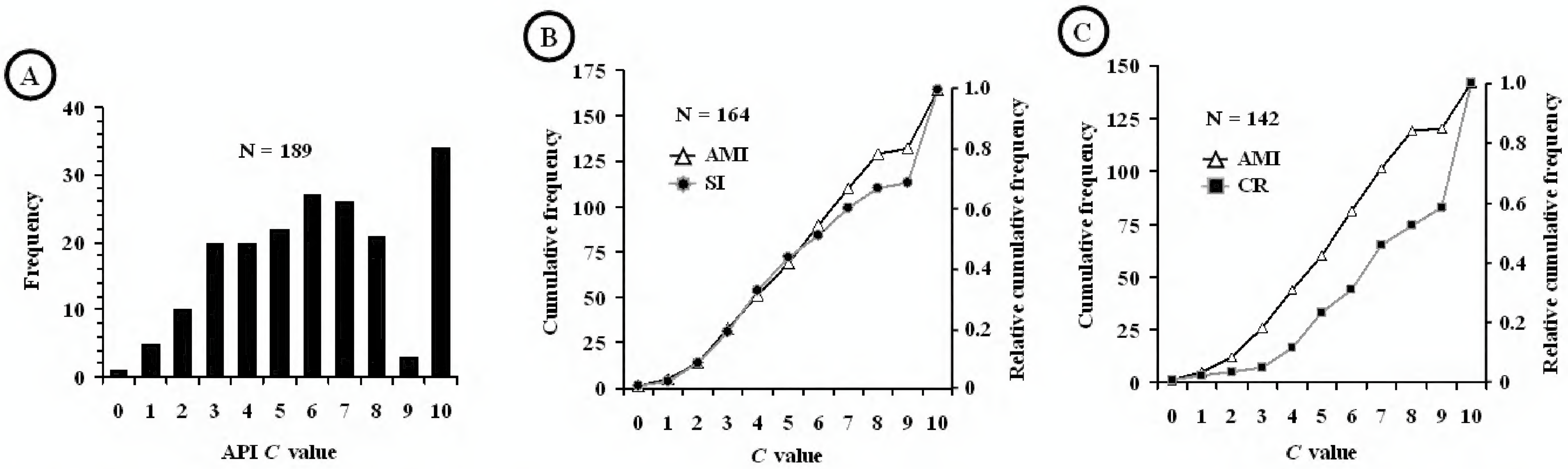

Figure 3. Frequency distributions of Indiana *C* values of aquatic plants: A) Indiana distribution; B) comparison of AMI C values with SI C values (Rothrock 2004); C) comparison of AMI *C* values with CR *C* values (Swink and Wilhelm 1994). Frequency represents the number of taxa within a group.

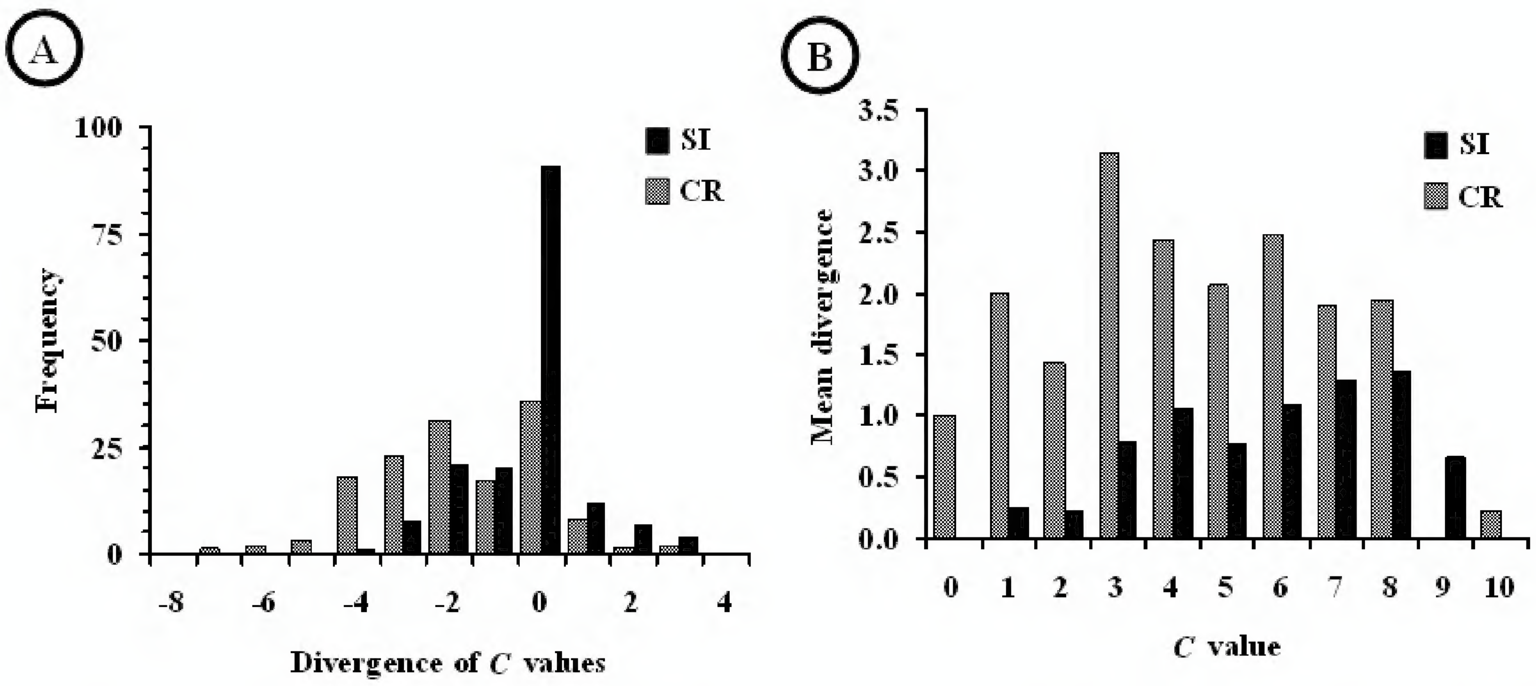

Figure 4. Frequency distributions of the divergence of AMI *C* values from SI and CR *C* values: A) overall divergence; B) mean divergence by *C* value. Frequency represents the number of taxa within a group.

Table 2. Checklist of obligate aquatic macrophytes of lacustrine habitats in Indiana. Taxa are arranged in a generally accepted systematic sequence by phylum and alphabetically by family, genus, species, and when applicable, subspecific and varietal ranks, respectively. For each taxon at or below the species rank, a common name, C value(s), taxon identification code (TIC), distributional range, and frequency of occurrence (F) have been included. A state rank (SR) has been provided for each state-listed taxon. C value: CR = Chicago Region (Swink and Wilhelm 1994); AMI = aquatic macrophytes of Indiana (proposed here); SI = State of Indiana (Rothrock 2004). A black circle (•) indicates that a taxon is considered non-native by the author(s), a black dagger (†) indicates that a C value was not assigned to a hybrid taxon to a hybrid, and a horizontal bar (—) indicates that the taxon is not listed by the author(s). Range: Z = statewide; N = north; S = south; E = east; W = west; C = central. Frequency of occurrence: A = abundant; C = common; O = occasional; R = rare. Each designation is largely defined by the presence/absence of a taxon across multiple aquatic habitats. State ranks: X = state extirpated; E = state endangered; T = state threatened; R = state rare; WL = watch list (from Indiana Natural Heritage Program 2007).

			C Value					
Taxon	Common Name	TIC	CR	AMI	SI	Range	F	SR
PHYLUM CHLOROPHYTA								
Family Characeae								
Genus *Chara*								
C. aspera Dethard. ex Willd., 1809	Rough stonewort	CHAASP	—	8	—	N, E	O	
C. braunii C. C. Gmel., 1826	Braun's muskgrass	CHABRA	—	5	—	Z	O	
C. brittonii Allen ex C. B. Rob., 1906	Britton's stonewort	CHABRI	—	10	—	N, E	R	
C. contraria A. Braun ex Kütz., 1845	Opposite stonewort	CHACON	—	2	—	Z	A	
C. foliolosa Muhl. ex Willd., 1805	Leafy stonewort	CHAFOL	—	7	—	Z	O	
C. globularis Thuill., 1799	Fragile stonewort	CHAGLO	—	4	—	Z	A	
C. haitensis Turpin, 1817	Haitian stonewort	CHAHAI	—	6	—	Z	O	
C. hydropitys Rchb., 1829	Water pine	CHAHYD	—	7	—	Z	R	
C. virgata Kütz., 1834	Delicate stonewort	CHAVIR	—	8	—	N, E	R	

Table 2. (Continued).

			C Value					
Taxon	**Common Name**	**TIC**	**CR**	**AMI**	**SI**	**Range**	**F**	**SR**
C. vulgaris L., 1753	Common stonewort	CHAVUL	—	6	—	Z	O	
C. zeylanica Klein ex Willd., 1805	Ceylonian muskgrass	CHAZEY	—	7	—	Z	O	
Genus *Nitella*								
N. acuminata A. Braun ex Wallman, 1853	Sharp-pointed muskgrass	NIAACU	—	6	—	W, S, C	O	
N. flexilis (L.) C. Agardh, 1824	Flexible stonewort	NIAFLE	—	4	—	Z	C	
N. megacarpa Allen, 1880	Large-fruited Stonewort	NIAMEG	—	7	—	N, E	O	
N. opaca (Bruzelius) C. Agardh, 1824	Split-branched muskgrass	NIAOPA	—	5	—	NE	O	
N. tenuissima (Desv.) Kütz., 1843	Dwarf muskgrass	NIATEN	—	3	—	N, E	O	
Genus *Nitellopsis*								
N. obtusa (Desv.) J. Groves, 1919	Starry stonewort	NIOOBT	•	•	•	NE	R	
Genus *Tolypella*								
T. intricata (Trentep. ex Roth) Leonh., 1864	Tassel stonewort	TOLINT	—	5	—	N, E	R	
T. prolifera (Ziz ex A. Braun) Leonh., 1863	Tassel stonewort	TOLPRO	—	5	—	N, E	R	
PHYLUM MARCHANTIOPHYTA								
Family Ricciaceae								
Genus *Riccia*								
R. fluitans L., 1753	Common riccia	RIAFLU	—	6	—	Z	C	
Genus *Ricciocarpos*								
R. natans (L.) Corda in Opiz, 1829	Purple-fringed riccia	RIONAT	—	7	—	N	R	
PHYLUM LYCOPODIOPHYTA								
Family Isoëtaceae								
Genus *Isoëtes*								
I. engelmannii A. Braun, 1846	Engelmann's quillwort	ISOENG	—	10	10	S	R	E
I. melanopoda Gay & Durieu, 1864	Black-footed quillwort	ISOMEL	10	4	4	S	R	T
PHYLUM EQUISETOPHYTA								
Family Equisetaceae								
Genus *Equisetum*								
E. arvense L., 1753	Common horsetail	EQUARV	0	1	1	Z	C	
E. fluviatile L., 1753	River horsetail	EQUFLU	7	10	10	Z	O	
PHYLUM POLYPODIOPHYTA								
Family Azollaceae								
Genus *Azolla*								
A. caroliniana Willd., 1810	Carolina mosquito fern	AZOCAR	10	7	4	Z	O	T
Family Marsileaceae								
Genus *Marsilea*								
M. quadrifolia L., 1753	European water-clover	MARQUA	—	•	•	S	R	
Family Thelypteridaceae								
Genus *Thelypteris*								
T. palustris Schott, 1834 var. *pubescens* (G. Lawson) Fernald, 1929	Marsh fern	THEPAP	6	7	7	Z	C	
PHYLUM MAGNOLIOPHYTA								
Family Acanthaceae								
Genus *Justicia*								
J. americana (L.) Vahl, 1791	American water-willow	JUSAME	6	6	6	Z	O	
Family Alismataceae								
Genus *Alisma*								
A. subcordatum Raf., 1808	Southern water-plantain	ALISUB	4	2	2	Z	C	
A. triviale Pursh, 1814	Northern water-plantain	ALITRI	4	2	2	N, E, W	O	
Genus *Echinodorus*								
E. berteroi (Spreng.) Fassett, 1955	Tall burhead	ECHBER	—	10	10	W	R	X
E. cordifolius (L.) Griseb., 1857 subsp. *cordifolius*	Creeping burhead	ECHCOC	—	10	10	S	R	E
E. tenellus (Mart.) Buchenau, 1868	Little burhead	ECHTEN	—	10	10	N, E	R	E
Genus *Sagittaria*								
S. ambigua J. G. Sm., 1894	Kansas arrowhead	SAGAMB	—	10	—	S, W	R	
S. australis (J. G. Sm.) Small, 1903	Appalachian arrowhead	SAGAUS	—	5	5	S, E	R	R
S. brevirostra Mackenz. & Bush, 1905	Midwestern arrowhead	SAGBRE	7	3	3	Z	O	
S. cuneata E. Sheld., 1893	Northern arrowhead	SAGCUN	8	6	3	Z	O	
S. graminea Michx. 1803 subsp. *graminea*	Grass-leaved arrowhead	SAGGRG	9	9	9	Z	C	
S. latifolia Willd., 1805	Wapato	SAGLAT	4	3	3	Z	C	
S. montevidensis Cham. & Schlect., 1827								

Table 2. (Continued).

Taxon	Common Name	TIC	*C* Value CR	*C* Value AMI	*C* Value SI	Range	F	SR
subsp. *calycina* (Engelm.) Bogin, 1955	Hooded arrowhead	SAGMOC	10	6	6	S, W, C	O	
S. rigida Pursh, 1814	Stiff arrowhead	SAGRIG	10	8	10	Z	O	
Family Apiaceae								
Genus *Hydrocotyle*								
H. americana L., 1753	Marsh-pennywort	HYOAMA	–	10	10	E	R	E
H. ranunculoides L. f., 1782	Buttercup-pennywort	HYORAN	•	6	–	S	R	
H. umbellata L., 1753	Water-pennywort	HYOUMB	10	7	7	N, E	O	
Genus *Sium*								
S. suave Walter, 1788	Hemlock water-parsnip	SIUSUA	7	6	5	Z	O	
Family Araceae								
Genus *Calla*								
C. palustris L., 1753	Water arum	CAAPAL	10	10	10	N	R	E
Genus *Peltandra*								
P. virginica (L.) Schott in Schott & Endl., 1832	Arrow arum	PELVIR	10	6	6	Z	O	
Genus *Pistia*								
P. stratiotes L., 1753	Water lettuce	PISSTR	–	•	–	S	R	
Family Asteraceae								
Genus *Bidens*								
B. beckii Torr. ex Spreng., 1821	Water marigold	BIDBEC	10	10	10	N	R	T
Family Brassicaceae								
Genus *Armoracia*								
A. lacustris (A. Gray) Al-Shehbaz & V. M. Bates, 1987	Lake cress	ARMLAC	10	8	8	Z	R	E
Genus *Rorippa*								
R. nasturtium-aquaticum (L.) Hayek, 1905	Water cress	RORNAS	•	•	•	Z	O	
R. palustris (L.) Bess., 1822								
var. *fernaldiana* (Butters & Abbe) Stuckey, 1972	Marsh cress	RORPAF	4	1	2	Z	R	
var. *hispida* (Desv.) Rydb., 1894	Hispid yellow cress	RORPAH	4	2	2	Z	R	
Family Butomaceae								
Genus *Butomus*								
B. umbellatus L., 1753	Flowering rush	BUTUMB	•	•	•	N	R	
Family Cabombaceae								
Genus *Brasenia*								
B. schreberi J. F. Gmel., 1791	Water-shield	BRASCH	10	6	4	Z	O	
Genus *Cabomba*								
C. caroliniana A. Gray, 1837	Fanwort	CABCAR	–	•	2	N, S	R	
Family Ceratophyllaceae								
Genus *Ceratophyllum*								
C. demersum L., 1753	Coontail	CERDEM	5	1	1	Z	A	
C. echinatum A. Gray, 1837	Prickly hornwort	CERECH	10	8	10	N, E	O	R
Family Clusiaceae								
Genus *Hypericum*								
H. boreale (Britton) E. P. Bichnell, 1890	Northern St. John's-wort	HYPBOR	10	7	8	N	O	
Family Cyperaceae								
Genus *Bolboschoenus*								
B. fluviatilis (Torr.) Soják, 1972	River bulrush	BOLFLU	4	4	4	Z	O	
Genus *Carex*								
C. aquatilis Wahlenb., 1803								
var. *substricta* Kük. in Engl., 1909	Water sedge	CARAQS	5	8	8	N, C	O	
C. atherodes Spreng., 1826	Wheat sedge	CARATH	5	6	6	N, C	R	E
C. comosa Boott, 1846	Bristly sedge	CARCOM	5	6	6	Z	C	
C. lacustris Willd., 1805	Common lake sedge	CARLAC	6	7	7	Z	O	
C. retrorsa Schwein., 1824	Bottlebrush sedge	CARRET	10	10	10	N	R	E
C. stipata Muhl. ex Willd., 1805								
var. *maxima* Chapm. ex Boott, 1862	Stalkgrain sedge	CARSTM	–	5	5	C, S	O	
var. *stipata*	Common fox sedge	CARSTS	3	2	2	Z	C	
C. stricta Lam. in Lam. et al., 1792	Common tussock sedge	CARSTR	5	5	5	Z	O	
C. typhina Michx., 1803	Cat-tail sedge	CARTYP	10	7	7	Z	O	
C. utriculata Boott in Hook, 1839	Yellow lake sedge	CARUTR	10	8	8	Z	O	
Genus *Cladium*								
C. mariscoides (Muhl.) Torr., 1836	Smooth sawgrass	CLAMAR	10	10	10	N, C	O	

Table 2. (Continued).

			C Value					
Taxon	Common Name	TIC	CR	AMI	SI	Range	F	SR
Genus *Dulichium*								
D. arundinaceum (L.) Britton, 1894 var. *arundinaceum*	Pond sedge	DULARA	9	10	10	Z	O	
Genus *Eleocharis*								
E. acicularis (L.) Roem. & Schult. in Roem. et al., 1817	Needle spike-rush	ELEACI	2	2	2	Z	C	
E. palustris (L.) Roem. & Schult. in Roem. et al., 1817	Common spike-rush	ELEPAL	10	6	8	Z	C	
Genus *Rhynchospora*								
R. corniculata (Lam.) A. Gray, 1835	Horned beak sedge	RHYCOR	–	3	3	C, S	R	T
Genus *Schoenoplectus*								
S. acutus (Muhl. ex Bigelow) Á. Löve & D. Löve, 1954 var. *acutus*	Hard-stem bulrush	SCHACA	6	4	5	Z	C	
S. pungens (Vahl) Palla, 1888	Chairmaker's rush	SCHPUN	5	3	3	Z	C	
S. subterminalis (Torr.) Soják, 1972	Water bulrush	SCHSUB	10	10	10	N	R	R
S. tabernaemontani (C. C. Gmel.) Palla, 1888	Soft-stem bulrush	SCHTAB	5	4	4	Z	C	
S. torreyi (Olney) Palla, 1912	Torrey's bulrush	SCHTOR	10	8	10	N	R	E
Family Eriocaulaceae								
Genus *Eriocaulon*								
E. aquaticum (Hill) Druce, 1919	Seven-angle pipewort	ERIAQU	10	10	10	N	R	E
Family Haloragaceae								
Genus *Myriophyllum*								
M. aquaticum (Vell.) Verdc., 1973	Parrot feather	MYRAQU	–	•	–	N	R	
M. heterophyllum Michx., 1803	Two leaf water-milfoil	MYRHET	10	5	7	N	O	
M. pinnatum (Walt.) Britton, Sterns, & Poggenb., 1888	Cutleaf water-milfoil	MYRPIN	10	8	10	N	R	E
M. sibiricum Kom., 1914	Northern water-milfoil	MYRSIB	7	7	7	N	O	
M. spicatum L., 1753	Eurasian water-milfoil	MYRSPI	•	•	•	Z	C	
M. tenellum Bigelow, 1824	Slender water-milfoil	MYRTEN	–	10	10	N, W	R	E
M. verticillatum L., 1753	Whorled water-milfoil	MYRVER	10	8	10	N	O	R
Genus *Proserpinica*								
P. palustris L., 1753	Mermaid weed	PROPAL	6	6	4	N	O	
Family Hydrocharitaceae								
Genus *Egeria*								
E. densa Planch., 1849	Brazilian water-weed	EGEDEN	–	•	•	S	R	
Genus *Elodea*								
E. canadensis Michx., 1803	Canadian water-weed	ELOCAN	5	3	3	Z	C	
E. nuttallii (Planch.) H. St. John, 1920	Slender water-weed	ELONUT	7	5	4	Z	O	
Genus *Hydrilla*								
H. verticillata (L. f.) Royle, 1839	Hydrilla	HYIVER	–	•	–	N, S	R	
Genus *Limnobium*								
L. spongia (Bosc) Rich. ex Steud., 1841	American frog-bit	LIMSPO	–	10	10	S	R	E
Genus *Vallisneria*								
V. americana Michx., 1803	Eel-grass	VALAME	7	4	7	Z	C	
Family Iridaceae								
Genus *Iris*								
I. pseudacorus L., 1753	Yellow water iris	IRIPSE	•	•	•	N, C	O	
I. virginica L., 1753	Blue flag	IRIVIR	5	5	5	Z	O	
Family Juncaceae								
Genus *Juncus*								
J. arcticus Willd., 1799 var. *balticus* (Willd.) Trautv., 1878	Baltic rush	JUNARB	6	6	6	N	R	R
J. canadensis J. Gay, 1825	Canada rush	JUNCAN	7	7	7	Z	O	
J. effusus L., 1753	Soft rush	JUNEFF	7	3	3	Z	C	
J. militaris Bigelow, 1824	Bayonet rush	JUNMIL	10	10	10	N	R	E
J. pelocarpus E. Mey., 1823	Brown-fruited rush	JUNPEL	10	10	10	N	R	E
Family Lemnaceae								
Genus *Lemna*								
L. aequinoctialis Welw., 1859	Lesser duckweed	LEMAEQ	•	3	5	S	R	
L. gibba L., 1753	Swollen duckweed	LEMGIB	9	10	10	N, C	R	
L. minor L., 1753	Common duckweed	LEMMIO	5	3	3	Z	C	

Table 2. (Continued).

				C Value				
Taxon	Common Name	TIC	CR	AMI	SI	Range	F	SR
L. minuta Kunth. in Humb. et al., 1816	Least duckweed	LEMMIU	5	4	3	Z	R	E
L. obscura (Austin) Daubs, 1965	Purple duckweed	LEMOBS	5	4	3	Z	O	
L. perpusilla Torr., 1843	Minute duckweed	LEMPER	10	8	10	N	R	X
L. trisulca L., 1753	Star duckweed	LEMTRI	7	6	6	Z	C	
L. turionifera Landolt, 1975	Turion duckweed	LEMTUR	5	4	3	N	R	
L. valdiviana Phil., 1864	Pale duckweed	LEMVAL	10	7	10	Z	R	E
Genus *Spirodela*								
S. polyrrhiza (L.) Schleid., 1839	Greater duckweed	SPIPOL	7	3	5	Z	C	
Genus *Wolffia*								
W. borealis (Engelm.) Landolt, 1977	Northern water-meal	WOABOR	7	5	4	Z	C	
W. brasiliensis Wedd., 1849	Brazilian water-meal	WOABRA	7	4	6	Z	O	
W. columbiana H. Karst., 1865	Common water-meal	WOACOL	7	3	5	Z	C	
Genus *Wolffiella*								
W. gladiata (Hegelm.) Hegelm., 1895	Sword bogmat	WOEGLA	10	7	5	N, W	R	E
Family Lentibulariaceae								
Genus *Utricularia*								
U. cornuta Michx., 1803	Naked bladderwort	UTRCOR	10	10	10	N, E	R	T
U. geminiscapa Benj., 1847	Mixed bladderwort	UTRGEM	10	10	10	N	R	E
U. gibba L., 1753	Creeping bladderwort	UTRGIB	10	3	4	Z	C	
U. intermedia Hayne, 1800	Northern bladderwort	UTRINT	10	8	8	N, E	R	WL
U. macrorhiza LeConte, 1824	Common bladdrewort	UTRMAC	9	4	5	Z	C	
U. minor L., 1753	Lesser bladderwort	UTRMIN	10	7	10	N	R	T
U. purpurea Walter, 1788	Purple bladderwort	UTRPUR	10	8	10	N, E	O	R
U. radiata Small, 1903	Floating bladderwort	UTRRAD	10	10	10	N	R	E
U. resupinata B. D. Greene ex Bigelow, 1840	Resupinate bladderwort	UTRRES	10	10	10	N	R	E
U. subulata L., 1753	Slender bladderwort	UTRSUB	10	10	10	N	R	T
Family Lythraceae								
Genus *Ammannia*								
A. coccinea Rottb., 1773	Tooth-cup	AMMCOC	—	3	2	S	O	
A. robusta Heer & Regel, 1842	Sessile tooth-cup	AMMROB	4	3	2	S	O	
Genus *Didiplis*								
D. diandra (Nutt.) A. Wood, 1855	Water-purslane	DIDDIA	10	6	6	N, W, S	R	E
Genus *Decodon*								
D. verticillatus (L.) Elliott, 1821	Swamp loosestrife	DECVER	8	7	8	Z	C	
Genus *Lythrum*								
L. salicaria L., 1753	Purple loosestrife	LYTSAL	•	•	•	Z	C	
Genus *Menyanthes*								
M. trifoliata L., 1753	Buckbean	MENTRI	10	8	10	N	R	WL
Genus *Nymphoides*								
N. peltata (S. G. Gmel.) Kuntze, 1891	Floating heart	NYOPEL	—	•	•	Z	R	
Family Najadaceae								
Genus *Najas*								
N. flexilis (Willd.) Rostk. & Schmidt, 1824	Nodding waternymph	NAJFLE	6	5	5	Z	C	
N. gracillima (A. Braun ex Engelm.)	Slender waternymph	NAJGRA	—	9	10	N, W, S	R	T
N. guadalupensis (Spreng.) Magnus, 1870								
subsp. *guadalupensis*	Southern naiad	NAJGUG	8	4	5	Z	O	
subsp. *olivacea* (Rosend. & Butters)								
R. R. Haynes & Hellq., 1996	Guadalupe waternymph	NAJGUO	—	7	—	N	R	
N. marina L., 1753	Spiny naiad	NAJMAR	•	•	•	N, E, C	O	WL
N. minor All., 1785	Brittle naiad	NAJMIN	•	•	•	Z	O	
Family Nelumbonaceae								
Genus *Nelumbo*								
N. lutea Willd., 1799	American lotus	NELLUT	9	7	4	Z	O	WL
N. nucifera Gaertn., 1788	Indian lotus	NELNUC	—	•	—	NE	R	
Family Nymphaeaceae								
Genus *Nuphar*								
N. advena (Aiton) W. T. Aiton, 1811								
subsp. *advena*	Yellow pond-lily	NUPADA	7	3	6	Z	A	
N. variegata Engelm. ex Durand inClinton, 1866	Bull-head pond-lily	NUPVAR	8	8	8	N, E	R	
Genus *Nymphaea*								
N. odorata Aiton, 1789								

Table 2. (Continued).

Taxon	Common Name	TIC	CR	AMI	SI	Range	F	SR
			C Value					
subsp. *tuberosa* (Paine) Wiersema & Hellq., 1994	White water-lily	NYAODT	7	5	6	Z	C	
Family Onagraceae								
Genus *Ludwigia*								
L. decurrens Walter, 1788	Wingstem water-primrose	LUDDEC	—	3	4	S	O	
L. glandulosa Walter, 1788								
subsp. *glandulosa*	Small water-primrose	LUDGLA	—	2	3	S	R	
L. leptocarpa (Nutt.) H. Hara, 1953	Water-willow	LUDLEP	—	•	•	S	R	
L. palustris (L.) Elliott, 1816	Marsh purslane	LUDPAL	5	3	3	Z	O	
L. peploides (Kunth) P. H. Raven, 1962								
var. *glabrescens* (Kuntze) Shinners, 1964	Creeping water-primrose	LUDPEG	—	2	2	C, W, S	O	
L. polycarpa Short & Peter, 1835	Top-pod water-primrose	LUDPOL	6	3	4	Z	O	
L. sphaerocarpa Elliott, 1817	Round-pod water-primrose	LUDSPH	10	5	4	NW, N	R	
Family Plantaginaceae								
Genus *Callitriche*								
C. heterophylla Pursh., 1813	Large water-starwort	CAIHET	9	6	3	Z	O	
C. palustris L., 1753	Common water-starwort	CAIPAL	10	6	—	Z	O	
Genus *Hippuri*s								
H. vulgaris L., 1753	Mare's tail	HIPVUL	10	8	10	N, E	R	X
Family Poaceae								
Genus *Calamagrostis*								
C. canadensis (Michx.) P. Beauv., 1812								
var. *canadensis*	Bluejoint	CAMCAC	3	5	5	Z	C	
Genus *Glyceria*								
G. striata (Lam.) Hitchc., 1928	Ridged glyceria	GLYSTR	4	4	4	Z	C	
Genus *Phalaris*								
P. arundinacea L., 1753	Reed canarygrass	PHAARU	•	1	•	Z	C	
Genus *Phragmites*								
P. australis (Cav.) Trin. ex Steud., 1841								
subsp. *americanus* Saltonst.,								
P. M. Peterson, & Soreng, 2004	American common reed	PHRAUM	1	0	0	Z	O	
Genus *Zizania*								
Z. aquatica L., 1753								
var. *aquatica*	Southern wildrice	ZIZAQA	10	10	10	N, C	R	
Z. palustris L., 1771								
var. *interior* (Fassett) Dore, 1969	Interior wildrice	ZIZPAI	—	10	10	N	R	
Family Polygonaceae								
Genus *Persicaria*								
P. amphibia (L.) Gray, 1821	Water smartweed	PERAMP	4	4	4	Z	C	
P. hydropiper (L.) Spach, 1841	Marsh-pepper smartweed	PERHYR	2	•	•	Z	C	
P. hydropiperoides (Michx.) Small, 1903	Swamp smartweed	PERHYO	7	3	3	Z	O	T
Genus *Rumex*								
R. altissimus Alph. Wood, 1847	Pale dock	RUMALT	2	2	2	Z	C	
R. britannica L., 1753	British dock	RUMBRI	8	7	7	Z	O	
R. verticillatus L., 1753	Swamp dock	RUMVER	6	5	5	Z	C	
Family Pontederiaceae								
Genus *Eichhornia*								
E. crassipes (Mart.) Solms in DC. & C. DC., 1883	Water-hyacinth	EICCRA	—	•	•	S	R	
Genus *Heteranthera*								
H. dubia (Jacq.) MacMill., 1892	Water star-grass	HETDUB	8	5	4	Z	C	
H. reniformis Ruiz & Pav., 1798	Kidney-leaf mud-plantain	HETREN	—	9	10	S	R	
Genus *Pontederia*								
P. cordata L., 1753	Pickerel-weed	PONCOR	10	6	5	Z	C	
Family Potamogetonaceae								
Genus *Potamogeton*								
P. amplifolius Tuck., 1848	Broad-leaved pondweed	POTAMP	10	7	10	Z	C	
P. bicupulatus Fernald, 1932	Snail-seed pondweed	POTBIC	—	10	10	N	R	E
P. crispus L., 1753	Curly-leaf pondweed	POTCRI	•	•	•	Z	C	
P. diversifolius Raf., 1808	Water-thread pondweed	POTDIV	9	6	4	N, S, W	O	
P. epihydrus Raf., 1811	Ribbon-leaf pondweed	POTEPI	10	10	10	N	R	E
P. foliosus Raf., 1808								
subsp. *foliosus*	Leafy pondweed	POTFOF	7	4	4	Z	C	
P. friesii Rupr., 1845	Fries Pondweed	POTFRI	10	7	10	N, E	R	T

Table 2. (Continued).

Taxon	Common Name	TIC	*C* Value CR	*C* Value AMI	*C* Value SI	Range	F	SR
P. gramineus L., 1753	Variable-leaved pondweed	POTGRA	8	5	7	Z	C	
P. illinoensis Morong, 1880	Illinois pondweed	POTILL	7	4	7	N, E	C	
P. natans L., 1753	Floating-leaf pondweed	POTNAT	7	7	8	N, E, W	O	
P. nodosus Poir. in Lam. et al., 1816	Long-leaf pondweed	POTNOD	5	4	4	Z	C	
P. oakesianus J. W. Robbins, in A. Gray, 1867	Oakes pondweed	POTOAK	–	10	10	N, E	R	E
P. praelongus Wulfen, 1805	White-stemmed pondweed	POTPRA	10	8	10	N, E	O	T
P. pulcher Tuck., 1843	Spotted pondweed	POTPUL	10	10	10	N	R	E
P. pusillus L., 1753 subsp. *pusillus*	Small pondweed	POTPUP	7	5	4	Z	R	WL
subsp. *tenuissimus* (Mert. & Koch) R. R. Haynes & Hellq., 1996	Slender pondweed	POTPUT	–	3	4	Z	C	
P. ×rectifolius A. Benn., 1902	Erect-leaved pondweed	POTREC	–	†	–	N	R	
P. richardsonii (A. Benn.) Rydb., 1905	Richardson's pondweed	POTRIC	10	7	10	N, E	R	R
P. robbinsii Oakes, 1841	Robbins' pondweed	POTROB	10	10	10	N, E	R	R
P. ×spathuliformis (J. W. Robbins) Morong, 1893	Variable pondweed	POTSPA	–	†	–	N, E	R	
P. strictifolius A. Benn., 1902	Stiff pondweed	POTSTR	10	8	10	N, E	R	T
P. ×undulatus Wolfg. in Schult. & Schult. f., 1827 (pro sp.)	Red-veined pondweed	POTUND	–	†	–	NE	R	
P. vaseyi J. W. Robbins in A. Gray, 1867	Vasey's pondweed	POTVAS	10	10	10	N	R	E
P. zosteriformis Fernald, 1932	Flatstem pondweed	POTZOS	8	4	8	Z	C	
Genus *Stuckenia*								
S. pectinata (L.) Börner, 1912	Sago-pondweed	STUPEC	5	2	3	Z	A	
Family Primulaceae								
Genus *Hottonia*								
H. inflata Elliott, 1817	American featherfoil	HOTINF	–	8	9	S	R	T
Genus *Lysimachia*								
L. nummularia L., 1753	Moneywort	LYSNUM	•	•	•	Z	C	
L. thyrsiflora L., 1753	Swamp loosestrife	LYSTHY	9	7	7	N, C	O	
L. vulgaris L., 1753	Garden loosestrife	LYSVUL	•	•	•	N	O	
Family Ranunculaceae								
Genus *Caltha*								
C. palustris L., 1753	Cowslip	CATPAL	5	6	7	Z	O	
Genus *Ranunculus*								
R. aquatilis L., 1753 var. *diffusus* With, 1796	White water crowfoot	RANAQD	8	5	7	Z	C	
R. flabellaris Raf., 1818	Yellow water crowfoot	RANFLA	7	7	7	Z	O	
R. sceleratus L., 1753 var. *sceleratus*	Cursed crowfoot	RANSCS	6	5	3	Z	O	
Family Saururaceae								
Genus *Saururus*								
S. cernuus L., 1753	Lizard's-tail	SAUCER	9	6	4	Z	C	
Family Scrophulariaceae								
Genus *Bacopa*								
B. rotundifolia Wettst. in Engl. & Prantl., 1891	Disc water-hyssop	BACROT	–	6	4	S, W	R	T
Genus *Veronica*								
V. anagallis-aquatica L., 1753	Water-speedwell	VERANA	10	4	5	Z	O	
Family Sparganiaceae								
Genus *Sparganium*								
S. americanum Nutt., 1818	American bur-reed	SPAAME	10	8	10	Z	O	
S. androcladum (Engelm.) Morong, 1888	Branched bur-reed	SPAAND	10	8	9	W, E	R	T
S. emersum Rehmann, 1872	Narrow-leaved bur-reed	SPAEME	10	6	8	N, C, E	C	
S. eurycarpum Engelm. in A. Gray, 1856	Giant Bur-reed	SPAEUR	6	5	5	N, C, E	O	
S. natans L., 1753	Small bur-reed	SPANAT	10	10	10	N	R	
Family Typhaceae								
Genus *Typha*								
T. angustifolia L., 1753	Narrow-leaved cat-tail	TYPANG	1	•	•	Z	A	
T. ×glauca Godr., 1844 (pro sp.)	Hybrid cat-tail	TYPGLA	1	†	†	N	O	
T. latifolia L., 1753	Broad-leaved cat-tail	TYPLAT	1	1	1	Z	A	
Family Zannichelliaceae								
Genus *Zannichellia*								
Z. palustris L., 1753	Horned-pondweed	ZANPAL	10	6	6	Z	O	R

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